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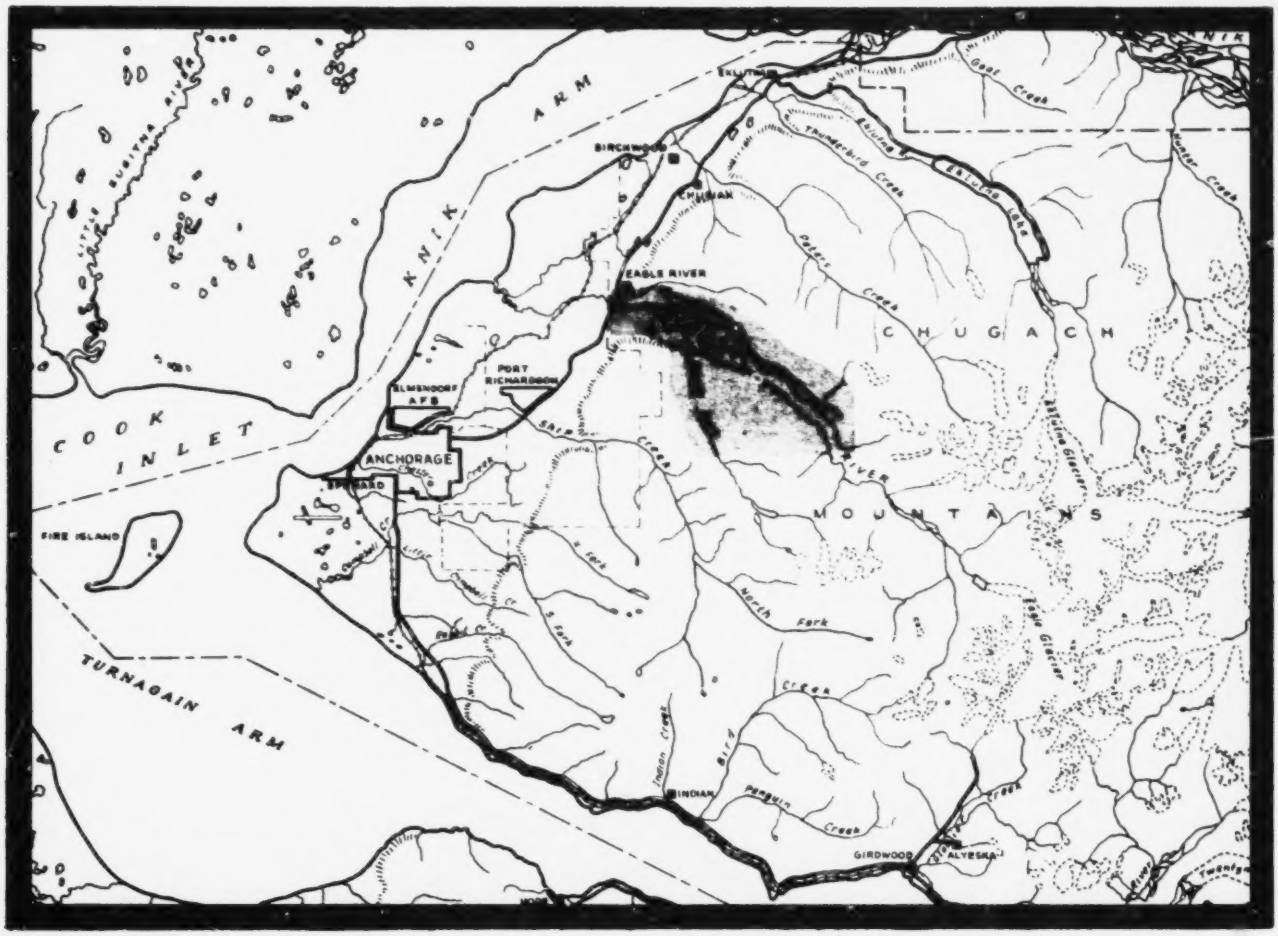
HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81



U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 82-362

PREPARED IN COOPERATION WITH THE MUNICIPALITY OF ANCHORAGE

U.S. DEPARTMENT OF THE INTERIOR · MARCH 3, 1849 ·

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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By Gary B. Deeter and Raymond S. George

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1982

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas Peck, Director

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CONVERSION TABLE

Multiply	By	To obtain
inches (in.)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)
cubic feet per second (ft^3/s)	0.0283	cubic meters per second (m^3/s)
gallons per minute (gal/min)	0.06309	liters per second (L/s)
tons/acre-foot	7.353×10^{-4}	metric tons/cubic meter ($tons/m^3$)
tons/day	0.9072	metric tons/day
degrees Fahrenheit (°F)	(°F-32)/1.8	degrees Celsius (°C)

Milligrams per liter (mg/L), micrograms per liter (µg/L) and micromhos per centimeter (µmho/cm) are standard reporting units.

National Geodetic Vertical Datum of 1929 (NGVD) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level".

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HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81

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INTRODUCTION

The Metropolitan Anchorage Urban Study (MAUS), which was completed in 1979, identified the Eagle River valley north of Anchorage, Alaska (fig. 1) as a potential source of water supply from outside the Anchorage bowl (U.S. Army Corps of Engineers, 1979). As part of a study to evaluate the feasibility of developing ground water in the valley for a public supply, the Municipality of Anchorage Water and Sewer Utility retained the engineering consulting firm CH_2M Hill to define the geologic materials above bedrock. The U.S. Geological Survey participated in the collection of geologic data during the consultant's test-well drilling program and collected hydrologic data in the middle reach of Eagle River valley in 1980 and 1981. This report is a compilation of those data.

The U.S. Geological Survey has studied the water resources of the Eagle River valley periodically since 1966 as part of a cooperative program with the Municipality of Anchorage, and three Geological Survey reports on hydrologic conditions have been published: Zenone, Schmoll, and Dobrovolny (1974); Dearborn (1977); and Johnson (1979). Schmoll, Dobrovolny, and Gardner (1980) provided information on the glacial history and sediments in the study area. Dearborn and Schaefer (1981) interpreted surface geophysical data to infer depth to bedrock and general sedimentary layering along two traverses in the middle reach of the valley.

TEST DRILLING

Between September 1980 and March 1981, eight 6-inch diameter wells were drilled in the middle reach of the Eagle River valley (figs. 1 and 2). Test wells 1 through 4 were drilled between a valley-floor tributary and the main stem of Eagle River along a segment of one of the two geophysical survey lines of Dearborn and Schaefer (1981). The depth to bedrock in test well 2 is 750 ft, significantly greater than that inferred from interpretation of their seismic refraction and electrical resistivity data. Test well 5 was drilled on a second geophysical survey line about 6,000 ft upvalley (southeast) of the first line. Test well 7 was drilled at the confluence of the South Fork Eagle River and the main stem to verify results of earlier test drilling (Tryck, Nyman & Hayes and others, 1973; and Dearborn, 1977). Test wells 6 and 8 were drilled approximately 1.5 mi upstream from the Glenn Highway bridge. These latter two wells breached bedrock at much shallower depths than would have been expected from geophysical interpretations (Dearborn and Schaefer, 1981). All eight test wells penetrated predominantly fine-grained material -- silt and clay-size (table 1). CH_2M Hill (1981) concluded that no aquifers capable of supplying large yield public supply wells were present in any of the drilling areas. No aquifer tests were conducted.

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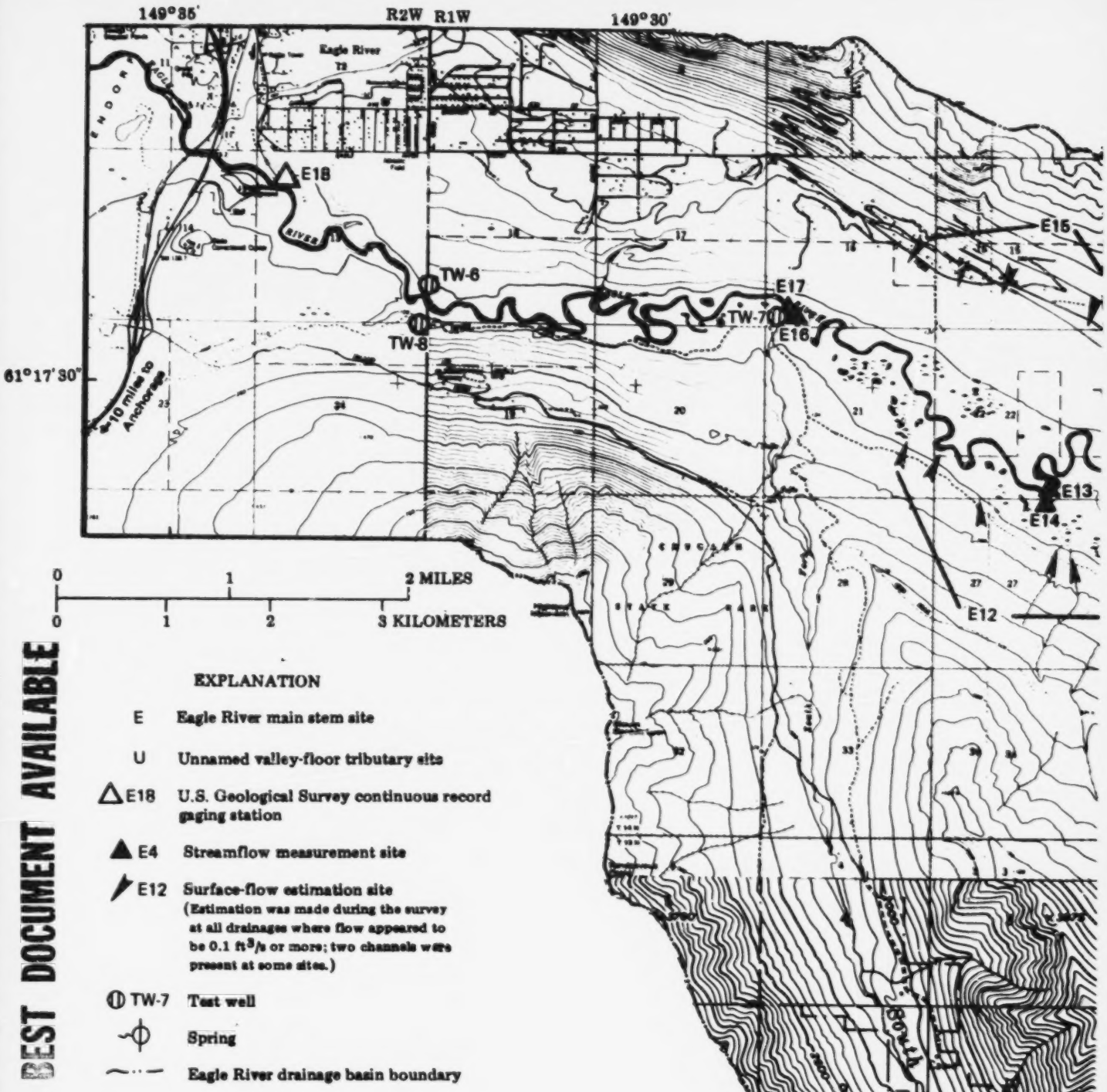

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Base credits:

North from 61°15', base from U.S. Geological Survey, Anchorage (B-7, SW/4 and SE/4) 1:25,000, 1979. Contours and elevations in meters. Contour interval 20 meters. NGVD of 1929.

South from 61°15', base from U.S. Geological Survey, Anchorage (A-7) 1:63,360 (enlarged), 1960. Contours and elevations in feet. Contour interval 100 feet. NGVD of 1929.

Figure 1.--Location of data collection stations, test wells, springs, and the measurement sites for the low-flow seepage runs.

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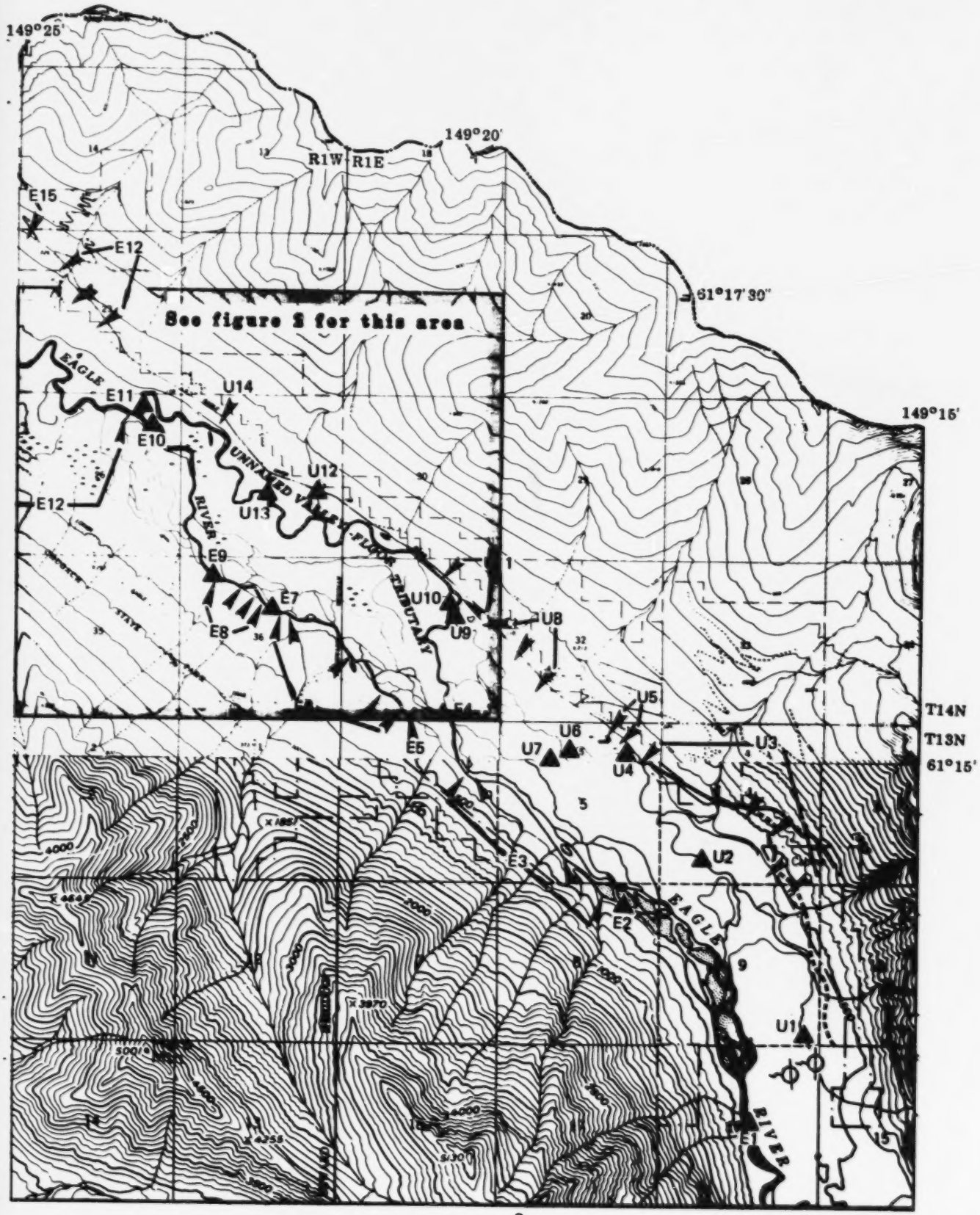

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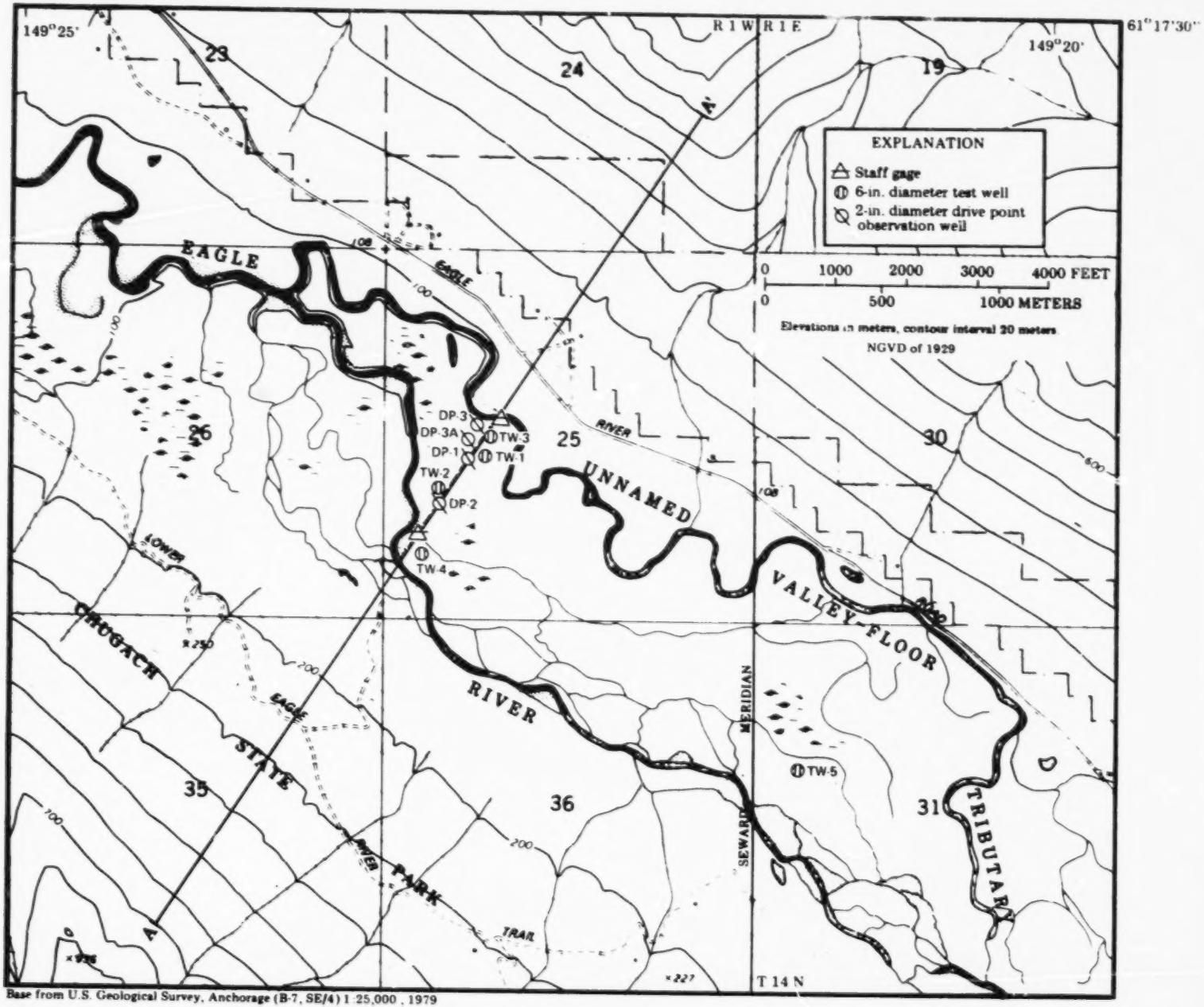

Base from U.S. Geological Survey, Anchorage (B-7, SE/4) 1:25,000, 1979

Figure 2.--Location of test wells, drive-point observation wells, and staff gages.

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LOW-FLOW MEASUREMENTS AND GROUND-WATER LEVELS

To define the relationship between ground water and surface water, two study techniques were used:

(1) Streamflow measurements were made during a period of low-flow (no surface runoff) to determine any changes in discharge that could be attributed to flow of ground water into or out of the channel.

(2) Observation wells were placed near some of the test wells to determine the slope of the water table and thus the inferred direction of ground-water flow.

On April 23 and 30, 1980, hydrographers from the Geological Survey made streamflow measurements in a 17-mile reach of Eagle River to determine gains and losses of discharge (fig. 1). Tables 2a and 2b list these measurements and indicate the residual gains or losses after accounting for surface inflow. The measurable precipitation at Anchorage International Airport for the 5-day periods that preceded and included the measurement days was 0.04 and 0.01 in., respectively. All valley-floor and low-altitude snow had melted and run off before the two surveys; thus hydrologic conditions were considered favorable for assuming low-flow conditions in Eagle River valley. Overall net gains in discharge not accounted for by surface-water inflows were measured in both the main stem and the valley-floor tributary of the river.

During September 1980, four 2-inch diameter drive-point observation wells were installed near test wells 1, 2, and 3 to monitor unconfined (shallow) ground-water levels under static (non-pumping) conditions and during any future pumping of the test wells. Although the test wells have not been pumped to date, water levels have been measured periodically in the observation wells and at river staff gages installed on both the main stem and the valley-floor tributary of Eagle River. Hydrographs of these water levels are shown in figure 3. Figure 4 shows the relation of the shallow ground-water levels and stream levels to the land surface on one of the measurement dates.

WATER-QUALITY DATA

Water samples were collected for chemical analysis from two springs, from two of the drive-point observation wells, and from two sites on the valley-floor tributary. Tables 3a and 3b list the location of the sample sites and the analytical results. The two springs, which issue from the toe of an apparent landslide deposit, each had a discharge of about 1.5 ft^3/s when they were sampled on September 26, 1980. A sample was collected from the valley-floor tributary approximately 1,000 ft downstream from the springs on the same date. On October 16, 1980, the wells were each pumped for 5 minutes before water samples were collected. A sample of the valley-floor tributary was taken at the staff gage on October 23, 1980.

Water temperatures were measured periodically at the four observation wells and at the staff gage on the valley-floor tributary (fig. 5). All values for a particular date were obtained within a 1-hour time span. The graph shows the changes in water temperature over the period of data collection, as well as the time lags and differences between surface water and ground water in the rate and range of temperature fluctuations.

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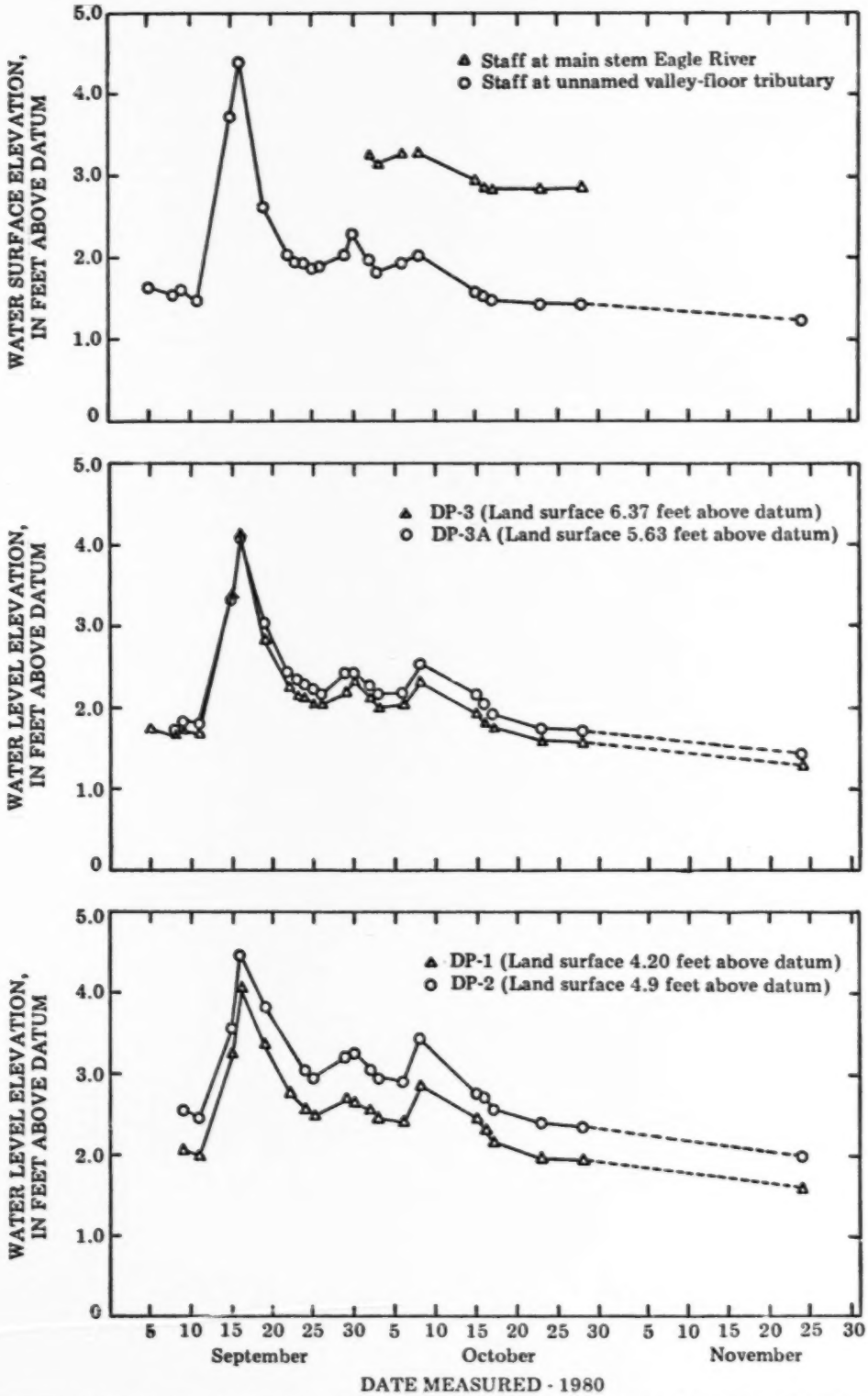
WATER SURFACE ELEVATION, IN FEET ABOVE DATUM
Staff at main stem Eagle River
Staff at unnamed valley-floor tributary
WATER LEVEL ELEVATION, IN FEET ABOVE DATUM
DP-3 (Land surface 6.37 feet above datum)
DP-3A (Land surface 5.63 feet above datum)
WATER LEVEL ELEVATION, IN FEET ABOVE DATUM
DP-1 (Land surface 4.20 feet above datum)
DP-2 (Land surface 4.9 feet above datum)
5.0
4.0
3.0
2.0
1.0
0
5 10 15 20 25 30 5 10 15 20 25 30 5 10 15 20 25 30
September
October
November
DATE MEASURED - 1980

Figure 3.--Hydrographs for two river staff gages and four 2-inch drive-point (DP) observation wells along line A - A', middle reach Eagle River. See figure 2 for location of line.

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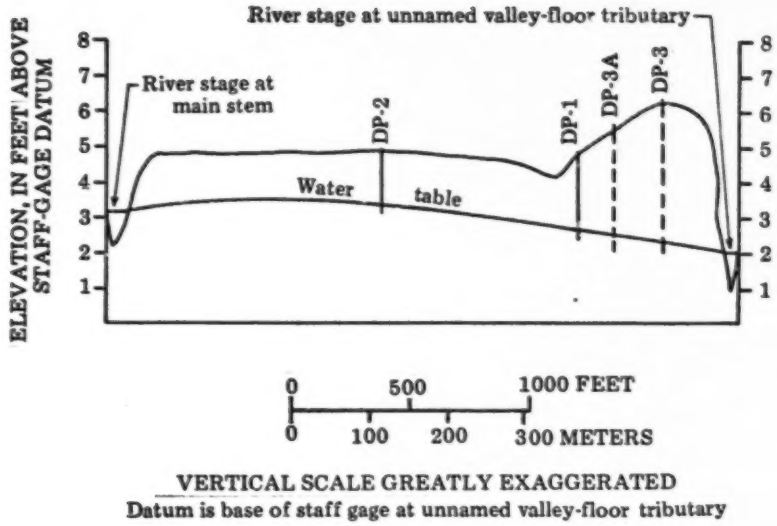

Figure 4.--Water surface relative to land surface obtained from water-level measurements at two staff gages and four drive-point observation wells along the part of line A-A' that lies between the two channels, middle reach Eagle River - October 8, 1980. See figure 2 for location of line.

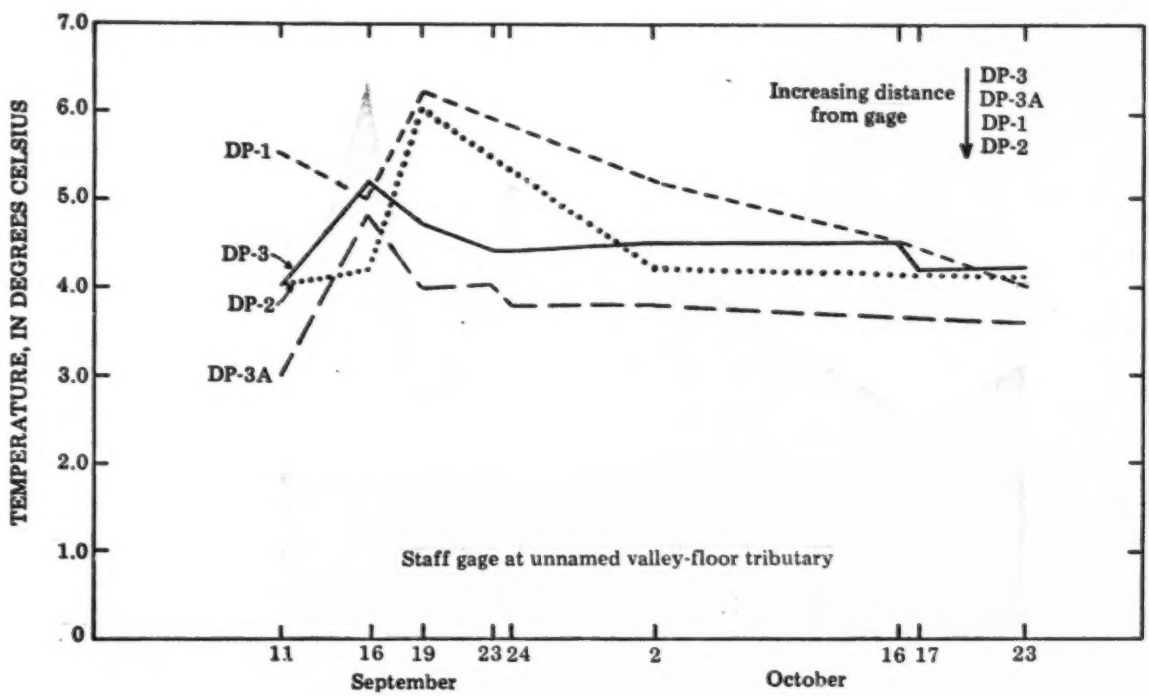

Figure 5.--Water temperatures obtained at the staff gage in unnamed valley-floor tributary and four drive-point observation wells along line A-A', middle reach Eagle River. See figure 2 for location of line.

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Table 1.--Geologic materials logs of test wells. See figures 1 and 2 for locations. Information compiled from field notes of well drilling contractor.

TEST WELL 1

Depth of interval in feet below land surface datum	Lithology
0-1.5	silts, very little organics
1.5-24	silty gravel, saturated below 2 feet
24-46	clayey silt
46-76	clay, sticky, some sand and gravel stringers
76-255	clay, sticky
255-295	clay, sticky, some sand and gravel stringers
295-306	gravelly hardpan, moderate difficulty drilling
306-314	rock (?), pebbles and clay chunks bailed up along with freshly broken greenstone, very difficult drilling

TEST WELL 2

Depth of interval in feet below land surface datum	Lithology
0-7.5	silts
7.5-19	silty gravel, saturated
19-28	clayey silt
28-46	silty sand and gravel
46-64	clayey silt
64-267	clay, sticky, silty near top
267-271.5	well graded silty sand, yields less than 60 gal/min
271.5-333	silty sand and gravel, seepage, some gravelly hardpan stringers
333-369	gravelly clay
369-409	clay, sticky
409-439	silty clay
439-465	clay, sticky
465-537	clay, sticky, with some gravel
537-544	gravelly sand
544-550	silty clayey gravel
550-629	silty clay and gravel
629-690	grey silty clay
690-700	sand and gravel, estimated yield of 60 gal/min
700-750	silt and fine sand
750-765	bedrock

TEST WELL 3

Depth of interval in feet below land surface datum	Lithology
0-10	organic silts
10-37	silt, seepage, some sand and gravel stringers
37-58	clay, some sand and gravel stringers
58-64	gravelly clay, seepage
64-90	sandy clay, very sticky, seepage, open hole closes if left to stand
90-143	sandy clay
143-235.5	sandy clay, seepage
235.5-237	silty sand, some clay and gravel
237-263	silty sand and gravel, some clay, seepage
263-293	sandy clay, some gravel
293-339	clay, seepage
339-342	clay, some gravel, seepage
342-344	cemented cobbles, greenstone fragments, very difficult drilling
344-351	clay

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Table 1.--Continued

TEST WELL 4

Depth of interval in feet below land surface datum	Lithology
0-5	silty sand and gravel
5-15	sandy silt
15-20	(no record available)
20-25	sand, some gravel
25-33	silty sand, some gravel
33-55	sandy silt
55-65	sandy clayey silt
65-71	silty clay
71-73	sandy silty clay
73-80	clayey sand
80-85	sandy clay
85-130	grey clay, some sand

TEST WELL 5

Depth of interval in feet below land surface datum	Lithology
0-30	silty clay
30-48	clayey silt, some gravel
48-55	gravelly clay
55-115	silty clay, some gravel
115-305	grey clay, soft

TEST WELL 6

Depth of interval in feet below land surface datum	Lithology
0-2	organic silts
2-21	sandy gravel, seepage
21-37	silty gravelly hardpan, grey
37-58	silty gravel
58-116	silty gravelly clay, grey
116-122	silty gravel, some clay
122-158	bedrock

TEST WELL 7

Depth of interval in feet below land surface datum	Lithology
0-4	organic silts
4-15	coarse sand and gravel
15-16	silty sand, some gravel
16-50	blue clay, some silt

TEST WELL 8

Depth of interval in feet below land surface datum	Lithology
0-2	organic silts
2-7	sand
7-17	silty grey clay
17-60	grey clay
60-63	gravelly clay
63-72	sand and gravel, seepage
72-86	bedrock

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Table 2a.--Results of low-flow seepage investigations - April 23, 1980.
e = estimated

Site number	River mile Revised*	River mile Prev. publ.	Stream	Location	Specific conductance, in umhos/cm at 25°C	Flow, in ft³/s Inflow	Flow, in ft³/s Main stem	Flow, in ft³/s Gain or loss
EAGLE RIVER								
E1	26.0	24.2	Eagle River	SW¼,SW¼,NE¼, sec. 16, T. 13 N., R. 1 E.----------	230	--	58.6	--
E4	22.5	--	....do....	SE¼,SW¼,SE¼, sec. 31, T. 14 N., R. 1 E.----------	220	--	62.5	+3.9
E5	--	--	inflow	SE¼,SE¼,SW¼, sec. 31, T. 14 N., R. 1 E.----------	140	0.7	--	--
E6	--	--	inflows (5)	SE¼,SE¼,SW¼, sec. 31, T. 14 N., R. 1 E.; sec. 36, T. 14 N., R. 1 W.----------	--	e1.9	--	--
E7	21.1	--	Eagle River	NW¼,SW¼,NE¼, sec. 36, T. 14 N., R. 1 W.----------	220	--	64.1	-1.0
E8	--	--	inflows (4)	SW¼,NE¼,NE¼, sec. 36, T. 14 N., R. 1 W.----------	--	e0.8	--	--
E9	20.7	19.0	Eagle River	NE¼,NW¼,NW¼, sec. 36, T. 14 N., R. 1 W.----------	240	--	65.7	+0.8
E10	19.4	--	....do....	SW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., above trib.---------	230	--	73.1	+7.4
E11	19.3	17.8	major valley-floor trib.	NW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., at mouth----------	--	46.6	--	--
E12	--	--	inflows (9)	NW¼,NE¼,NE¼, secs. 15, 16, & 23, T. 14 N., R. 1 W.----------	--	e1.5	--	--
E16	14.1	--	Eagle River	SE¼,SW¼,SW¼, sec. 16, T. 14 N., R. 1 W., above So. Fork------	230	--	134.6	+13.4
E17	14.0	13.2	South Fork	SW¼,SW¼,SW¼, sec. 16, T. 14 N., R. 1 W., 100 ft above mouth--	170	12.6	--	--
E18	9.0	8.5	Eagle River	SW¼,NW¼,NW¼, sec. 13, T. 14 N., R. 2 W., gaging station 15277100----------	220	--	148.9	+1.7
				Overall net gain				+26.2
UNNAMED VALLEY-FLOOR TRIBUTARY								
U1	7.9	--	main stem	SE¼,SE¼,SE¼, sec. 9, T. 13 N., R. 1 E., at State Park foot bridge----------	210	--	10.2	--
U3,5, 8	--	--	inflows (12)	SE¼,SE¼,SE¼, secs. 4, 5, T. 13 N., R. 1 E., along Eagle R. Rd.----------	--	e4.8	--	--
U9	3.6	--	main stem	NE¼,SW¼,NE¼, sec. 31, T. 14 N., R. 1 E., 500 ft above Fk-----	210	--	40.3	+25.3
U10	3.5	--	tributary	NE¼,SW¼,NE¼, sec. 31, T. 14 N., R. 1 E., 100 ft above jct.---	--	0.9	--	--
U11	--	--	inflows (2)	NE¼,NW¼,NE¼, sec. 31, T. 14 N., R. 1 E., along right bank----	--	e0.8	--	--
U12	2.2	--	tributary	NW¼,NE¼,SE¼, sec. 25, T. 14 N., R. 1 W., at Eagle R. Rd.-----	240	1.2	--	--
U13	1.6	--	main stem	NW¼,NW¼,SE¼, sec. 25, T. 14 N., R. 1 W.----------	225	--	44.7	+1.5
U14	--	--	inflows (2)	NW¼,NW¼,NW¼, sec. 25, T. 14 N., R. 1 W., along Eagle R. Rd.--	240	e0.3	--	--
E11	0.1	--	main stem	NW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., 300 ft above mouth--	225	--	46.6	+1.6
				Overall net gain				+26.2

*Revised river mile values were determined by an electronic digitizer and found superior to previously assigned values.

Table 2b.--Results of low-flow seepage investigations - April 30, 1980.
e = estimated

Site number	River mile Revised*	River mile Prev. publ.	Stream	Location	Specific conductance, in umhos/cm at 25°C	Flow, in ft³/s Inflow	Flow, in ft³/s Main stem	Flow, in ft³/s Gain or loss
EAGLE RIVER								
E1	26.0	24.2	Eagle River	SW¼,SW¼,NE¼, sec. 16, T. 13 N., R. 1 E.	240	--	71.6	--
E2	24.3	--	....do....	SW¼,NE¼,NE¼, sec. 8, T. 13 N., R. 1 E.	155	--	68.6	-3.0
E3	--	--	inflows (4)	SW¼,NE¼,NE¼, secs. 5, 6, 8, T. 13 N., R. 1 E.	--	e1.3	--	--
E4	22.5	--	Eagle River	SE¼,SW¼,SE¼, sec. 31, T. 14 N., R.1 E.	230	--	74.3	+4.4
E5,6,8	--	--	inflows (10)	SE¼,SW¼,SE¼, sec. 31, T. 14 N., R. 1 E.; sec. 36, T. 14 N., R. 1 W.	--	e4.1	--	--
E9	20.7	19.0	Eagle River	NE¼,NW¼,NW¼, sec. 36, T. 14 N., R. 1 W.	225	--	83.2	+4.8
E10	19.4	--	....do....	SW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., above trib.	--	--	86.9	+3.7
E11	19.3	17.8	major valley-floor trib.	NW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., at mouth	--	44.6	--	--
E12	--	--	inflows (6)	NW¼,NE¼,NE¼, secs. 23 & 26, T. 14 N., R. 1 W.	--	e1.2	--	--
E13	16.8	--	Eagle River	SE¼,SW¼,SE¼, sec. 22, T. 14 N., R. 1 W., above trib.	--	--	130.0	-2.7
E14	--	--	inflow	SE¼,SW¼,SE¼, sec. 22, T. 14 N., R. 1 W.	155	1.4	--	--
E15	--	--	inflows (9)	SE¼,SW¼,SE¼, secs. 15, 16, 21, 27, T. 14 N., R. 1 W.	--	e1.6	--	--
E16	14.1	--	Eagle River	SE¼,SW¼,SW¼, sec. 16, T. 14 N., R. 1 W., above So. Fk.	230	--	141.7	+8.7
E17	14.0	13.2	South Fork	SW¼,SW¼,SW¼, sec. 16, T. 14 N., R. 1 W., 100 ft above mouth	160	17.6	--	--
E18	9.0	8.5	Eagle River	SW¼,NW¼,NW¼, sec. 13, T. 14 N., R. 2 W., gaging station 15277100	--	--	162.1	+2.8
				Overall net gain				+18.7
UNNAMED VALLEY-FLOOR TRIBUTARY								
U1	7.9	--	main stem	SE¼,SE¼,SE¼, sec. 9, T. 13 N., R. 1 E., at State Park foot bridge	200	--	11.0	--
U2	6.4	--	...do...	NW¼,SE¼,SW¼, sec. 4, T. 13 N., R. 1 E., 200 ft blw beaver dam	210	--	18.0	+7.0
U3	--	--	inflows (7)	NW¼,SE¼,S½, sec. 4, T. 13 N., R. 1 E., along Eagle R. Rd.	--	e3.8	--	--
U4	5.4	--	main stem	SW¼,NE¼,NE¼, sec. 5, T. 13 N., R. 1 E.	--	--	28.7	+6.9
U5	--	--	inflows (2)	NE¼,NW¼, and NW¼,NE¼ of NE¼, sec. 5, T. 13 N., R. 1 E.	--	e0.5	--	--
U6	4.9	--	main stem	SE¼,NE¼,NW¼, sec. 5, T. 13 N., R. 1 E., 100 ft above trib.	--	--	30.9	+1.7
U7	--	--	tributary	SW¼,NE¼,NW¼, sec. 5, T. 13 N., R. 1 E., 1000 ft above jct.	--	2.6**	--	--
U8	--	--	inflows (3)	SW¼,NE¼,W½, sec. 32, T. 14 N., R. 1 E., along Eagle R. Rd.	--	e0.9	--	--
U9	3.6	--	main stem	NE¼,SW¼,NE¼, sec. 31, T. 14 N., R. 1 E., 500 ft above fk.	--	--	38.1	+3.7
U10	3.5	--	tributary	NE¼,SW¼,NE¼, sec. 31, T. 14 N., R. 1 E., 100 ft above jct.	--	0.9**	--	--
U11	--	--	inflows (2)	NE¼,NW¼,NE¼, sec. 31, T. 14 N., R. 1 E., along right bank	--	e0.8	--	--
U12	2.2	--	tributary	NW¼,NE¼,SE¼, sec. 25, T. 14 N., R. 1 W., at Eagle R. Rd.	--	1.7	--	--
U13	1.6	--	main stem	NW¼,NW¼,SE¼, sec. 25, T. 14 N., R. 1 W.	--	--	42.8	+1.3
U14	--	--	inflows (2)	NW¼,NW¼,NW¼, sec. 25, T. 14 N., R. 1 W., along Eagle R. Rd.	--	e0.2	--	--
E11	0.1	--	main stem	NW¼,NE¼,NE¼, sec. 26, T. 14 N., R. 1 W., 300 ft above mouth	--	--	44.6	+1.6
				Overall net gain				+22.2

*Revised river mile values were determined by an electronic digitizer and found superior to previously assigned values.
**Shallow underflow or ground water(?)

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Table 3a.--Chemical characteristics and constituents of water - 1980. e = estimated (Analyses by U.S. Geological Survey)

Sample site name	Location	Specific conductance, field measurements (umho/cm 25°C)	Temperature (°C)	pH (units, field measurements)	Dissolved solids, residue at 180°C (mg/L)	Dissolved solids, sum of constituents (mg/L)	Dissolved solids (tons/day)	Dissolved solids (tons/acre-foot)	Hardness (mg/L as $CaCO_3$)	Noncarbonate hardness (mg/L as $CaCO_3$)	Silica, dissolved (mg/L as SiO_2)	Calcium, dissolved (mg/L as Ca)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field measurements (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Nitrogen, NO_2+NO_3, dissolved (mg/L as N)	Nitrogen, ammonia + organic, total (mg/L as N)	Phosphorus, dissolved (mg/L as P)
Middle spring at head, valley-floor trib.	SW¼,NE¼,NE¼, sec. 16, T. 13 N., R. 1 E	200	3.5	--	122	121	--	0.17	99	26	5.9	34	2.5	0.4	73	27	0.4	0.0	0.84	--	0.01
East spring at head, valley-floor trib.	SE¼,NE¼,NE¼, sec. 16, T. 13 N., R. 1 E.	162	5.0	--	101	100	e0.41	e0.14	62	8	9.1	20	7.4	1.6	54	13	13	0.1	0.05	--	0.01
Drive point 45 ft from valley-floor trib. near test well 3	SW¼,SE¼,NW¼, sec. 25, T. 14 N., R. 1 W.	350	4.5	7.2	226	200	--	0.31	140	0	5	46	3.0	0.7	--	1.4	0.8	0.0	0.00	0.50	0.18
Drive point near test well 1	NE¼,NW¼,SW¼, sec. 25, T. 14 N., R. 1 W.	326	4.5	6.8	187	186	--	0.25	150	0	2	54	3.8	1.0	160	5.8	2.5	0.0	0.00	--	0.03
Valley-floor tributary near staff gage	NW¼,NE¼,SW¼, sec. 25, T. 14 N., R. 1 W.	195	3.0	6.2	117	116	22.2	0.16	95	18	5.9	31	3.3	0.4	--	22	1.2	0.0	0.33	--	0.03
Valley-floor tributary below springs	SE¼,SE¼,SE¼, sec. 9 T. 13 N., R. 1 E.	195	5.0	--	123	118	4.98	0.17	95	23	5.8	32	2.7	0.4	72	26	0.6	0.0	0.75	--	0.01

Table 3b.--Dissolved metals in water - 1980. Values in micrograms per liter. (Analyses by U.S. Geological Survey)

Sample site name	Location	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Selenium	Silver	Zinc
Middle spring at head, valley-floor trib.	SW¼,NE¼,NE¼, sec. 16, T. 13 N., R. 1 E	2	10	1	0	2	20	0	3,500	1	0.0	0	0	<3
East spring at head, valley-floor trib.	SE¼,NE¼,NE¼, sec. 16, T. 13 N., R. 1 E.	2	50	<1	20	4	50	2	3,000	4	0.0	0	0	20
Drive point 45 ft from valley-floor trib. near test well 3	SW¼,SE¼,NW¼, sec. 25, T. 14 N., R. 1 W.	6	90	2	0	2	24,000	0	6,100	1,500	0.0	0	0	--
Drive point near test well 1	NE¼,NW¼,SW¼, sec. 25, T. 14 N., R. 1 W.	15	60	<1	0	2	3,100	1	4,700	1,800	0.0	0	0	--
Valley-floor tributary near staff gage	NW¼,NE¼,SW¼, sec. 25, T. 14 N., R. 1 W.	2	20	2	0	4	30	2	4,200	50	0.0	0	0	5
Valley-floor tributary below springs	SE¼,SE¼,SE¼, sec. 9 T. 13 N., R. 1 E.	2	20	<1	0	4	40	2	3,600	5	0.0	0	0	10

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